

App. No. 10/522,488
Office Action Dated March 17, 2008

REMARKS

Favorable reconsideration is respectfully requested in view of the above amendments and following remarks. Applicants appreciate the courtesy shown by the Examiner in discussing this case with Applicants' representative on June 24, 2008. The discussions of the interview are reflected in the following remarks.

Claim 1 has been amended. The limitation in claim 1 concerning the ratio of the alkali metal (other than Na) and the alkaline-earth metal to a total of the sodium (Na), the alkali metal (other than Na) and the alkaline-earth metal being in a range from 0.1 to 30 mol% is supported for example by page 5, lines 26-30. Claims 1-20 and 61-64 are pending. No new matter has been added.

Claim rejections - 35 U.S.C. § 103

Claims 1-20 and 61-64 have been rejected under 35 U.S.C. §103(a) as obvious over DiSalvo (US 6,579,645) in view of Kelsey (US 2002/0158267). Applicants respectfully traverse this rejection.

The method of claim 1 requires the use of a mixed flux having contents with a ratio of the alkali metal (other than Na) and the alkaline-earth metal to a total of the sodium (Na), the alkali metal (other than Na) and the alkaline-earth metal in a range from 0.1 to 30 mol%, with a Group III-element nitride being caused to grow. The advantageous effects of the method according to claim 1 are indicated by the results shown for example in Examples 1, 3, 4, 6, 8, and 10 and Figs. 2, 4, 6 and 10 of the specification.

The rejection contends that one of ordinary skill in the art would combine Kelsey and DiSalvo as the Kelsey reference gives motivation to add more than one flux, and further contends that the use of two fluxes will not damage the making of GaN. Applicants

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respectfully submit that the rejection is relying on the improper use of hindsight in the interpretation of Kelsey.

In particular, at the time of filing of the present application, conventional understanding in the art was that GaN single crystal formation was not possible if alkaline-earth metals were used as a flux together with Na. For example, as shown by Yamane et al. in Acta Cryst. C52, pp. 760-761 (1996), in experiments where more than a catalytic amount of Ba is added to preparations using Na as a flux, an alkaline earth gallium nitride, $\text{Ba}_3\text{Ga}_2\text{N}_4$, is formed rather than GaN (for the Examiner's convenience, the Yamane reference is filed herewith). This was an expected outcome, as the reference notes that formation of other alkaline earth gallium nitrides such as Mg_3GaN_3 , Ca_6GaN_5 and CaGaN had been reported previously. Moreover, it was generally understood that addition of alkaline-earth metals and alkali metals should be avoided particularly in the semiconductor process as such an addition changes the carrier density and other relevant properties in the substrate.

Contrary to such conventional understanding, Applicants unexpectedly have found that a colorless, transparent, and high quality Group-III-element nitride single crystal can be produced in higher yields as compared to using Na alone as a flux when the crystals are prepared as required by claim 1, as shown for example by Examples 1, 3, 4, 6, 8 and 10 and Figs. 2 to 4, 6 and 10. Nothing in the references teaches or suggests using at least one of alkaline-earth metals and alkali metals other than Na in amounts as required by claim 1 for the formation of Group-III-element nitride single crystals, nor any reason to expect that at least one of alkaline-earth metals and alkali metals other than Na could be combined with Na as a mixed flux and achieve the benefit of superior Group-III-element nitride single crystal formation shown in the present specification.

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As discussed above, conventional understanding at the time of the filing of the present application was that Kelsey's use of alkaline-earth metals or alkali metals other than Na together with Na as a mixed flux was not applicable to DiSalvo's GaN single crystal formation. Nothing in the reference provides any reasonable basis for combining at least one of alkaline-earth metals and alkali metals other than sodium with sodium as a mixed flux in amounts required by claim 1 for the formation of Group-III-element nitride single crystals. Accordingly, claim 1 and the dependent claims therefrom are patentable over the references, taken alone or separately.

Favorable reconsideration and withdrawal of the rejection are respectfully requested.

In view of the above, favorable reconsideration in the form of a notice of allowance is requested. Any questions or concerns regarding this communication can be directed to the attorney-of-record, Douglas P. Mueller, Reg. No. 30,300, at (612) 455.3804.



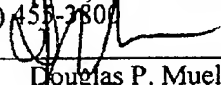
Dated: August 18, 2008

Respectfully submitted,

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